ภาคผนวก ก

ร้อยละองค์ประกอบของผลิตภัณฑ์ที่ได้จากปฏิกิริยาเอสเทอริฟิเคชัน
ระหว่างกลีเซอรอลกับกรดโอลีอิก

ตารางที่ ก.1 แสดงร้อยละองค์ประกอบของผลิตภัณฑ์ที่ได้จากปฏิกิริยาเอสเทอริฟิเคชันระหว่างกลีเซอรอลกับกรดโอลีอิก ที่เวลาในการทำปฏิกิริยาต่างๆ

เวลาในการทำปฏิกิริยา (นาที)	โมโนโอลีเอท (ร้อยละ)	ไดโอลีเอท (ร้อยละ)	ไตรโอลีเอท (ร้อยละ)	กรดโอลีอิก (ร้อยละ)
10	7.6	40.7	13.5	38.2
20	2.5	36.0	42.3	19.1
30	2.3	30.9	45.0	21.9
40	1.8	31.1	47.2	19.9
60	1.2	30.1	55.8	12.8
180	0.7	25.3	60.8	18.4
300	1.1	19.6	57.9	30.7

ตารางที่ ก.2 แสดงร้อยละองค์ประกอบของผลิตภัณฑ์ที่ได้จากปฏิกิริยาเอสเทอริฟิเคชันระหว่างกลีเซอรอลกับกรดโอลีอิก ที่อุณหภูมิต่างๆ

อุณหภูมิ (องศาเซลเซียส)	โมโนโอลีเอท (ร้อยละ)	ไดโอลีเอท (ร้อยละ)	ไตรโอลีเอท (ร้อยละ)	กรดโอลีอิก (ร้อยละ)
140	3.8	0.3	-	95.9
150	7.9	14.8	1.1	76.1
160	7.6	40.7	13.5	38.2

ตารางที่ ก.3 แสดงร้อยละองค์ประกอบของผลิตภัณฑ์ที่ได้จากปฏิกิริยาเอสเทอริฟิเคชันระหว่างกลีเซอรอลกับกรดโอลีอิก ที่ปริมาณตัวเร่งปฏิกิริยาต่างๆ

ปริมาณตัวเร่ง (ร้อยละโดยน้ำหนัก)	โมโนโอลีเอท (ร้อยละ)	ไดโอลีเอท (ร้อยละ)	ไตรโอลีเอท (ร้อยละ)	กรดโอลีอิก (ร้อยละ)
0.0	6.2	3.3	0.0	90.5
1.0	15.2	42.1	6.2	32.1
2.0	4.0	41.0	27.6	27.5
4.0	2.4	34.7	37.0	25.9
6.0	0.6	24.5	53.8	21.1

ตารางที่ ก.4 แสดงร้อยละองค์ประกอบของผลิตภัณฑ์ที่ได้จากปฏิกิริยาเอสเทอริฟิเคชันระหว่างกลีเซอรอลกับกรดโอลีอิก ที่สัดส่วนโดยโมลระหว่างกลีเซอรอลต่อกรดโอลีอิกต่างๆ

กลีเซอรอลต่อกรดโอลีอิก (โดยโมล)	โมโนโอลีเอท (ร้อยละ)	ไดโอลีเอท (ร้อยละ)	ไตรโอลีเอท (ร้อยละ)	กรดโอลีอิก (ร้อยละ)	ผลลัพท์ (ร้อยละ)
(0.5/1)	5.5±1.9	40.9±0.2	21.4±7.2	32.1±5.5	-
(2.5/1)	29.6±2.5	31.1±2.9	1.4±0.4	38.0±0.7	28.33
(5/1)	36.8±1.8	26.4±3.9	0.6±0.3	35.2±3.7	17.02
(7.5/1)	41.5±1.5	36.8±2.9	1.8±1.9	18.6±3.1	14.5
(10/1)	41.9±2.0	40.2±2.2	0.8±0.3	17.0±4.2	8.06
(15/1)	43.1±2.2	32.0±4.6	0.7±0.3	24.3±6.6	-
(20/1)	46.3±3.5	31.7±6.2	1.4±1.7	20.2±10.1	-

<u>การคำนวณค่า % yield</u>

สารละลายตัวอย่าง 2.5 มิลลิลิตร มีสารตัวอย่างอยู่ 0.0027 กรัม

ในการฉีดใช้สารตัวอย่าง 20 ไมโครลิตร ดังนั้นมีสารตัวอย่างอยู่เท่ากับ $(0.0027 \times 20 \times 10^{-6} \times 10^{3})/2.5$

$= 2.16 \times 10^{-5}$ กรัม

องค์ประกอบของสารตัวอย่างหลังจากวิเคราะห์ HPLC พบว่า

มี monooleate + dioleate + trioleate = 61.4 % และ Oleic acid = 38.6 %

ดังนั้น ในสารตัวอย่าง 2.16×10^{-5} กรัม จะมี มี monooleate + dioleate + trioleate

เท่ากับ $(61.4 \times 2.16 \times 10^{-5})/100 = 1.326 \times 10^{-5}$ กรัม

ถ้าสารที่สังเคราะห์ได้ทั้งหมดเท่ากับ 9.455 กรัม จะมี monooleate + dioleate + trioleate

$= (9.455 \times 1.326 \times 10^{-5})/2.16 \times 10^{-5}$

$= 5.804$ กรัม

CARLO ERBA REAGENTS GROUP Quality since 1853

Safety data sheet
according to 1907/2006/EC, Article 31

Printing date 13.03.2013 Version number 18 Revision: 13.03.2013

*
SECTION 1: Identification of the substance/mixture and of the company/undertaking

· **1.1 Product identifier**
· **Molecular formula:** C18 H34 O2
· **Trade name: oleic acid, pure**
· **MSDS number:** CH0569

· **EC number:**
204-007-1
· **1.2 Relevant identified uses of the substance or mixture and uses advised against**
No further relevant information available.
· **Application of the substance / the preparation** Chemical products for laboratory

· **1.3 Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Carlo Erba Reagenti
Viale Luraghi snc
I-20020 Arese(MI)
Tel.: 0039 02 953251
CARLO ERBA REAGENTI
Viale Luraghi snc
I-20020 Arese (MI)
Tel.: 0039 02 953251

CARLO ERBA REAGENTS
Chaussée du Vexin
Parc d'Affaires des Portes - BP616
27106 VAL DE REUIL Cedex
Téléphone: +02 32 09 20 00
Télécopie: +02 32 09 20 20

· **Further information obtainable from:**
Q.A / Normative
email ITALY: MSDS_CER@carloerbareagenti.com
email FRANCE: MSDS_CER-SDS@carloerbareactifs.com
· **1.4 Emergency telephone number:**
CENTRO ANTIVELENI OSPEDALE CA GRANDA - NIGUARDA (MI)
tel: 0039 02 66 10 10 29
numéro d'appel d'urgence ORFILA: 01 45 42 59 59

*
SECTION 2: Hazards identification

· **2.1 Classification of the substance or mixture**
· **Classification according to Regulation (EC) No 1272/2008**

GHS07

Skin Irrit. 2 H315 Causes skin irritation.
Eye Irrit. 2 H319 Causes serious eye irritation.
STOT SE 3 H335 May cause respiratory irritation.

· **Classification according to Directive 67/548/EEC or Directive 1999/45/EC**

Xi; Irritant

R36/37/38: Irritating to eyes, respiratory system and skin.
· **Information concerning particular hazards for human and environment:**
The product has to be labelled due to the calculation procedure of the "General Classification guideline for Substances of the EU", DIR. 67/548/EC, in the latest valid version, and of the "General Classification guideline for Preparations of the EU", DIR. 99/45/EC, in the latest valid version.

(Contd. on page 2)

Trade name: oleic acid, pure

(Contd. of page 1)

· **2.2 Label elements**
· **Labelling according to Regulation (EC) No 1272/2008**
The substance is classified and labelled according to the CLP regulation.
· **Hazard pictograms**

GHS07

· **Signal word** Warning
· **Hazard statements**
H315 Causes skin irritation.
H319 Causes serious eye irritation.
H335 May cause respiratory irritation.
· **Precautionary statements**

P261	Avoid breathing dust/fume/gas/mist/vapours/spray.
P271	Use only outdoors or in a well-ventilated area.
P304+P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P405	Store locked up.
P501	Dispose of contents/container in accordance with local/regional/national/international regulations.

· **Additional information:** Void
· **2.3 Other hazards** -
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

*
SECTION 3: Composition/information on ingredients

· **3.1 Chemical characterization: Substances**

· **CAS No. Description**
oleic acid, pure

· **Identification number(s)**

· **EC number:** 204-007-1

*
SECTION 4: First aid measures

· **4.1 Description of first aid measures**
· **After inhalation:** In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:**
Immediately wash with water and soap and rinse thoroughly. Wash contaminated clothing before reuse.
· **After eye contact:**
Rinse opened eye for several minutes under running water. If symptoms persist, consult a doctor.
· **After swallowing:** Do not induce vomiting; call for medical help immediately.
· **4.2 Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Information for doctor:** Show the doctor this Material Safety Data Sheet.
· **4.3 Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

(Contd. on page 3)

(Contd. of page 2)

*

SECTION 5: Firefighting measures

· **General Information:**
As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.
· **5.1 Extinguishing media**
· **Suitable extinguishing agents:**
CO2, powder or water spray. Fight larger fires with water spray or alcohol resistant foam.
· **5.2 Special hazards arising from the substance or mixture** Carbon monoxide and carbon dioxide
· **5.3 Advice for firefighters**
· **Protective equipment:** Do not inhale gases in case or fire or combustion.
· **Additional information** Keep receptacles cool with water spray.

*

SECTION 6: Accidental release measures

· **General Information:** Use proper personal protective equipment as indicated in Section 8.
· **6.1 Personal precautions, protective equipment and emergency procedures**
Use personal protective equipment.
· **6.2 Environmental precautions:**
Do not allow product to reach sewage system or any water course.
Do not allow to enter sewers/ surface or ground water.
Inform respective authorities in case of seepage into water course or sewage system.
· **6.3 Methods and material for containment and cleaning up:** Ensure adequate ventilation.
· **6.4 Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

*

SECTION 7: Handling and storage

· **7.1 Precautions for safe handling** Prevent formation of aerosols.
· **Information about fire - and explosion protection:** No special measures required.

· **7.2 Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** Store in a cool location.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** None.
· **7.3 Specific end use(s)** No further relevant information available.

*

SECTION 8: Exposure controls/personal protection

· **Additional information about design of technical facilities:** No further data; see item 7.

· **8.1 Control parameters**
· **Ingredients with limit values that require monitoring at the workplace:** TLV not established.
· **Additional information:** The lists valid during the making were used as basis.

· **8.2 Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing
Wash hands before breaks and at the end of work.
· **Respiratory protection:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.

(Contd. on page 4)

(Contd. of page 3)

· **Protection of hands:**
The selected protective gloves have to satisfy the specifications of EU Directive 89/689/EEC and the standard EN 374 derived from it.

Protective gloves

Rubber gloves
· **Material of gloves**
The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation.
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
The exact break trough time has to be found out by the manufacturer of the protective gloves and has to be observed.
· **Eye protection:** Tightly sealed goggles
· **Body protection:**
Choose body protection according to the amount and concentration of the dangerous substance at the work place.

*

SECTION 9: Physical and chemical properties

· **9.1 Information on basic physical and chemical properties**	
Molecular weight	282.47 g
· **Appearance:**	
Form:	Fluid
Colour:	Colourless
· **Odour:**	Odourless
· **Odour threshold:**	Not determined.
· **pH-value:**	Not determined.
· **Change in condition**	
Melting point/Melting range:	13.4 °C
Boiling point/Boiling range:	360 °C
· **Flash point:**	189 °C
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	360 °C
· **Decomposition temperature:**	Not determined.
· **Self-igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapour pressure at 176 °C:**	1.5 hPa
· **Density at 20 °C:**	0.9 g/cm³
· **Bulk density at 20 °C:**	893 kg/m³
· **Relative density**	Not determined.
· **Vapour density**	Not determined.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with water:**	Not miscible or difficult to mix.
· **organic solvents:**	Soluble in many organic solvents.
· **Partition coefficient (n-octanol/water):**	Not determined.

(Contd. on page 5)

(Contd. of page 4)

· **Viscosity:**
Dynamic: Not determined.
Kinematic: Not determined.
· **9.2 Other information** No further relevant information available.

*

SECTION 10: Stability and reactivity

· **10.1 Reactivity**
· **10.2 Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **10.3 Possibility of hazardous reactions** No dangerous reactions known.
· **10.4 Conditions to avoid** No further relevant information available.
· **10.5 Incompatible materials:** No further relevant information available.
· **10.6 Hazardous decomposition products:** Carbon monoxide, Carbon dioxide.

*

SECTION 11: Toxicological information

· **11.1 Information on toxicological effects**
· **Acute toxicity:**
· **Primary irritant effect:**
· **on the skin:** Irritant to skin and mucous membranes.
· **on the eye:** Classified as having irritating properties.
· **Ingestion:** It can be harmfull if swallowed.
· **Inhalation:** Harmful if inhaled. May cause respiratory tract irritation.
· **Sensitization:** No sensitizing effects known.
· **Other information (about experimental toxicology):** No more relevant data available.

*

SECTION 12: Ecological information

· **12.1 Toxicity**
· **Aquatic toxicity:** Foreseeable as non relevant.
· **12.2 Persistence and degradability** No further relevant information available.
· **Method**
· **Ecological information** Not available
· **Other information:** The product is hardly biodegradable.
· **12.3 Bioaccumulative potential** No further relevant information available.
· **12.4 Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (German Regulation) (Assessment by list): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **12.5 Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **12.6 Other adverse effects** No further relevant information available.

*

SECTION 13: Disposal considerations

· **13.1 Waste treatment methods**
· **Recommendation**
Must not be disposed together with household garbage. Do not allow product to reach sewage system.
Reutilise if possible or contact a waste processors for recycling or safe disposal.

(Contd. on page 6)

(Contd. of page 5)

· **Waste disposal key:**
The European Union does not establish uniform rules for the disposal of chemical waste, which are special waste. Their treatment and elimination of the domestic legislation of each country. So, in each case, you should contact the relevant authorities, or those companies legally authorized for elimination of waste.
2001/573/EC: Council Decision of 23 July 2001 amending the list of wastes contained in Decision 2000/532/EC.
Council Directive 91/156/EEC of 18 March 1991 amending Directive 75/442/EEC on waste.
· **Uncleaned packaging:**
The containers and packing materials contaminated with dangerous substances or preparations, have the same treatment products.
Directive 94/62/EC of the European Parliament and the Council of 20 December 1994 on packaging and packaging waste.
· **Recommendation:**
Disposal must be made according to official regulations.
Packagings that may not be cleansed are to be disposed of in the same manner as the product.
Wash with solvents to be incinerated.

*

SECTION 14: Transport information

· **14.1 UN-Number**	
· **ADR, IMDG, IATA**	-
· **14.2 UN proper shipping name**	
· **ADR, IMDG, IATA**	N.A.
· **14.3 Transport hazard class(es)**	
· **ADR, IMDG, IATA**	
· **Class**	Not classified - non dangerous product
· **14.4 Packing group**	
· **ADR, IMDG, IATA**	-
· **14.5 Environmental hazards:**	
· **Marine pollutant:**	No
· **14.6 Special precautions for user**	Not applicable.
· **UN "Model Regulation":**	2011

*

SECTION 15: Regulatory information

· **15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **National regulations:**

· **Information about limitation of use:** -
· **Waterhazard class:** Water hazard class 1 (Assessment by list): slightly hazardous for water.
· **15.2 Chemical safety assessment:** A Chemical Safety Assessment has been carried out.

*

SECTION 16: Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing MSDS:** Q.A./Normative

(Contd. on page 7)

(Contd. of page 6)

· **Contact:**
ITALY:
email: MSDS-CER@carloerbareagenti.com
Phone: 00 39 02 953251
FRANCE:
email: MSDS_CER-SDS@carloerbareactifs.com
Phone: +02 32 09 20 00

· **References**
ECDIN (Environmental Chem. Data and Information Network)
IUCLID (International Uniform Chemical Information Database)
NIOSH - Registry of Toxic Effects of Chemical Substances
Roth - Wassergefährdende Stoffe
Verschueren - Handbook of Environmental Data on Organic Chemicals
ChemDAT - Safety Data Sheets from E.Merck on CD-ROM
Merian - Metals and their compounds in the environment

· **Abbreviations and acronyms:**
RID: Règlement international concernant le transport des marchandises dangereuses par chemin de fer (Regulations Concerning the International Transport of Dangerous Goods by Rail)
ICAO: International Civil Aviation Organization
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)

· **Sources**
DIR. 67/548/EC, in the latest valid version.
Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006, REACH.
Regulation (EC) N° 1272/2008 of the European Parliament and of the Council of 16 December 2008, CLP, in the latest valid version.
Globally Harmonized System, GHS
ADR 2011

(Contd. on page 8)

(Contd. of page 7)

Annex: Exposure scenario

· ***Description of the activities / processes covered in the Exposure Scenario***
See section 1 of the annex to the Safety Data Sheet.
· ***Conditions of use***
· ***Duration and frequency*** *5 workdays/week.*
· ***Physical parameters***
· ***Concentration of the substance in the mixture*** *Raw material.*
· ***Other operational conditions***
· ***Other operational conditions affecting environmental exposure*** *No special measures required.*
· ***Other operational conditions affecting worker exposure***
Avoid contact with eyes.
Avoid contact with the skin.
· ***Other operational conditions affecting consumer exposure*** *No special measures required.*
· ***Other operational conditions affecting consumer exposure during the use of the product*** *Not applicable.*
· ***Risk management measures***
· ***Worker protection***
· ***Organisational protective measures*** *No special measures required.*
· ***Technical protective measures*** *Ensure that suitable extractors are available on processing machines*
· ***Personal protective measures***
Avoid contact with the skin.
Avoid contact with the eyes.
Tightly sealed goggles
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.
The selected protective gloves have to satisfy the specifications of EU Directive 89/689/EEC and the standard EN 374 derived from it.
Protective gloves
Rubber gloves
· ***Measures for consumer protection*** *Ensure adequate labelling.*
· ***Environmental protection measures***
· ***Water*** *No special measures required.*
· ***Disposal measures*** *Disposal must be made according to official regulations.*
· ***Disposal procedures***
Must not be disposed together with household garbage. Do not allow product to reach sewage system.
· ***Waste type*** *Partially emptied and uncleaned packaging*
· ***Exposure estimation***
· ***Consumer*** *Not relevant for this Exposure Scenario.*
· ***Guidance for downstream users*** *No further relevant information available.*

CARLO ERBA REAGENTS
Quality since 1853

Direzione, Uffici e Stabilimento
Strada Rivoltana Km 6/7
20090 Rodano (Mi)
Telefono 02-95325.1
Fax 02-95325.310/320

S.p.A.
Sede legale
Strada Rivoltana, Km 6/7
20090 Rodano (Mi)

Capitale Sociale € 5.000.000 i.v.
R.I., C.F., P.IVA n. 03273990964
R.E.A. Milano n. 1662256

S.Q.A. CERTIFICATO ISO 9001: 2000 N° 038/4

Certificate of Analysis

PRODUCT	:OLEIC ACID RE PURO		
CODE	:305704		
LOT N°	:0F199110F	*METHOD*	:6359
EXPIRING DATE	:06/2015	*EDITION*	2

TEST	U.M.	SPECIFICS	RESULT
Description	-	Clear yellow liquid	Conform
Identification	-	Positive	Positive
Density at 20° C	-	0.890 ÷ 0.910	0.89
Iodine value	-	>= 90	97.7
Assay (GLC)	%	55 ÷ 72	69.9

Statistical sampling executed in conformity with $\sqrt{n}+1$ and CER CQ000 procedure

Approve Date :23/06/2010

QUALITY CONTROL RESPONSIBLE
G. Dedotti

Product Data Sheet

OLEIC ACID

Oleic Acid is used in may application, including but not limited to: ester quats, sorbitol esters, surfactants, fabric liquids, soap oleates, fatty acids and acid esters, fatty amines, rubber, liquid AKD for paper applications, and in some paper softening applications.

Appearance: Light Yellow to Amber liquid

Product Properties

	Specifications	Typical Properties
Titer °C	-	6 maximum
Iodine Value	-	89 - 100
Acid Value	-	196 - 208
Color (Gardner 3.0 max)	-	1.0
Saponification Value	-	198 - 208

Typical Fatty Acid Composition (%)

	C14	C16	C16:1	C18	C18:1	C18:2	C18:3	
	1	5	7	1	69	15	2	

SAFETY INFORMATION: ..... Please refer to MSDS
AVAILABLE FORMS / PACKAGING: ..... Tank Truck-Totes-Drums
SHIPPING POINTS: ..... Atlanta, GA

The Nottingham Company
Div. of Performance Process Inc.

Sales and Technical Service: Atlanta, GA. (404) 351-3501

QC reviewed and approved on 11/1/04 (DJ)